

Analysis of the Food Environment Surrounding BC Schools

Baseline Report

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Prepared for:
British Columbia Ministry of Health Services

March 2011

Executive Summary:

The purpose of this project is to provide a baseline analysis of the current food environment surrounding elementary and secondary schools in British Columbia. This study examined the availability of beverage and snack food stores, fast food outlets, delis and convenience stores within 800 meters of 1392 public schools and the closest distance from schools to the nearest limited service food outlet. Food store data was obtained from the 2010 Canadian Business Data files and school-level data was obtained from the BC Ministry of Education. These preliminary findings reveal that in 2010 over half the public schools in BC (54%) had at least one limited service food outlet within a 10-12 minute walk (800m) from school grounds and over 60% of schools have at least one store located within 1.5km. Schools located in urban areas had higher exposure to all types of limited service vendors compared to schools in rural areas. No significant differences were found between secondary schools (schools serving grade 8 or higher) versus schools with younger students. Additional research is needed to understand how food environment exposures surrounding schools impact food choices and dietary quality.

Acknowledgements:

Funding for this project came from the British Columbia Ministry of Health Services. Sincere thanks to Natalie Work, GIS analyst from the Ministry of Citizens' Services, Demographic Analysis Section, BC Stats for providing geographic coordinates for BC schools. Thanks also to Chris Hvid, Research Officer, Analysis and Reporting Group, Ministry of Education for helping to identify and access relevant school data. Stuart Fleming, GIS analyst and student from the University of British Columbia provided GIS calculations and estimates pertaining to food store availability and proximity and contributed substantial input to map design and formatting.

1.0. Introduction and Purpose:

The purpose of this project is to provide a baseline analysis of the current food environment surrounding public schools in British Columbia (BC). This project specifically aims to provide a descriptive profile of the availability of fast food outlets, snack and beverage stores, limited service restaurants and convenience stores within 800 meters of BC schools to inform a broader ActNOW Communities initiative as part of the Ministry of Health Services' Prevention and Health Improvement Strategy.

2.0. Methods

2.1. School Data

The sample of schools in this analysis included 1392 public schools that were listed in the BC Ministry of Education's school database as of February 2011 (available at: <http://www.bced.gov.bc.ca/apps/imcl/imclWeb/SchoolMailingInfo.do>). Geographic coordinate data (latitude/longitude) were provided by the Demographic Analysis Section, BC Stats, Ministry of Citizens' Services¹ and were used to identify and map school locations. Schools were included in the analysis if they provided standard school programs and had a physical address that could be geocoded. Schools that the Ministry of Education did not identify as a standard school program, such as distributed learning programs and provincial resource programs were excluded. Schools that provide service to grade 8, 9, 10, 11 or 12 were considered to be a secondary school for the purpose of this analysis (n=380) and the remaining schools (without grade 8-12) were defined as elementary schools (n=1012). The mean number of students enrolled per school was 380 students (s.d. =336, median=293).

¹ For more specific information about the geocoding procedures used by the Ministry of Citizens' Services, contact Natalie Work, Natalie.J.Work@gov.bc.ca, tel: 250-387-0330 fax: 250-387-0380; www.bcstats.gov.bc.ca

2.1. Food Store Data and Definitions

Food retailer data (including latitude and longitude coordinates for each outlet) was obtained from the 2010 Canadian Business Data files maintained by Pitney Bowes Software Canada Inc. for the province of British Columbia. Several specifications were examined in order to identify limited service food providers, vendors primarily selling “fast food”, snack foods and convenience foods. Limited service outlets are defined in this study as outlets where food is selected and purchased before being consumed. Food store definitions were created in consultation with staff from the Ministry of Health Services, and where possible applied North American Industry Classification System (NAICS) descriptions to define and code outlets. Four main food store categories were subsequently defined and analyzed and are described below:

- A) **Beverage and snack food stores: 1511** outlets were identified with NAICS description “snack & nonalcoholic beverage bars”, a subcategory of NAICS code 72221 which includes limited service eating places. This category included chain vendors selling coffee, ice cream, donuts and snacks including Starbucks (n=331), Tim Hortons (n=228) and Dairy Queen (n=107) and also included independent coffee and snack vendors with a single location.
- B) **Fast Food Outlets: 1472** outlets were defined as restaurants without waiter service where customers select and purchase food before consumption (excluding limited service snack & nonalcoholic beverage bars described above in A). No NAICS code could be identified that reliably identified such vendors. In the Canadian Business Data files used here, fast food vendors such as Subway, McDonald’s, KFC and takeout pizza places were coded with NAICS description “full service restaurants” beginning with code 7221, and therefore could not be distinguished from other full service restaurants using NAICS codes alone. Therefore, all restaurants in the database

were tabulated and reviewed; outlets with three or more locations in BC meeting the proposed criteria for fast food were identified and coded as “fast food” and are listed below in Table 1.

Table 1: Fast Food Vendors (with 3 or more locations) in British Columbia

Name	Number of Outlets in BC	Name	Number of Outlets in BC
SUBWAY	342	VERA'S BURGER SHACK	8
MC DONALD'S	192	HARVEY'S	7
QUIZNOS	94	SIZZLING WOK	7
PANAGO PIZZA	90	FATBURGER	6
KFC	76	FORTUNE WOK	6
DOMINO'S PIZZA	68	MANCHU WOK	6
PIZZA HUT	55	MEGABITE PIZZA	6
WENDY'S	53	MRS VANELLI'S PIZZA & ITALIAN	6
LITTLE CAESARS PIZZA	46	VILLAGES PIZZA	6
BOOSTER JUICE	33	WOK BOX	6
BURGER KING	31	DONAIR TOWN	5
TACO DEL MAR	30	KOYA JAPAN	5
ORANGE JULIUS	27	PAPA JOHN'S PIZZA	5
FRESH SLICE PIZZA	26	CURRY EXPRESS	4
CANADIAN 2 FOR 1 PIZZA	25	DQ GRILL & CHILL	4
CHURCH'S CHICKEN	22	MR SUB	4
EXTREME PITA	17	NOODLE BOX	4
NEW YORK FRIES	17	STEAMROLLERS	4
PIZZA FACTORY	16	A & W RESTAURANTS	3
TRIPLE O'S	16	ABBY PIZZA PLACE LTD	3
TACO BELL	15	FLAMING WOK	3
FLYING WEDGE PIZZA CO	14	MEMPHIS BLUES BARBEQUE HOUSE	3
ARBY'S	13	MRS VANELLI'S	3
PITA PIT	11	RED BURRITO	3
WRAP ZONE	10	UMI SUSHI EXPRESS	3
NANDO'S CHICKEN	10	UMI SUSHI EXPRESS INC	3
Total		1,472	

C) **Delis: 249** food stores were coded with NAICS description “Limited-serve restaurants”.

These stores largely included delicatessens and prepared food/take out shops and 98.2% of were independent shops with only a single location.

D) **Convenience stores: 243** stores were classified with NAICS description “convenience stores” with the numeric NAICS code 44512001. Eighty two percent of these outlets were comprised of 7-Eleven and Mac’s Convenience Store outlets.

E) **All Food Outlets:** There were a total of **3475** limited service outlets identified in BC in 2010 that were comprised of beverage and snack food stores, fast food, delis and convenience stores (described in A-D). A fifth variable was therefore calculated to include all four food store categories into a comprehensive variable.

2.3. Other Relevant Variables

Potential differences in food store availability around schools were examined between rural and urban schools. Rural schools were defined as schools located in regions that fall outside of census tract boundaries in the 2006 Canadian Census. Census tracts are defined only in populous regions with a population of approximately 2,500 to 8,000 residents located in or near an urban core with a population of 50,000 residents or more [1]. In this sample there were 837 “urban” schools (i.e. schools in regions with a defined census tract) and 561 rural schools.

The socioeconomic attributes of the regions surrounding schools were also examined by evaluating the percent of residents earning incomes below the low-income cutoff² and by assessing the median annual household income estimated for the forward sortation area (FSA) surrounding schools. Forward sortation areas are the geographic locations represented by the first three digits of a Canadian postal code [2]. All schools in BC with a physical address have an assigned FSA area (defined by the first three digits of their postal codes). Maps describing the definitions of FSA regions in BC are provided in the appendix. The average annual median household income of the neighbourhoods (FSAs) surrounding this sample of schools was \$55,104 in 2006 (s.d.= \$11,819) with an average of 12.2% of residents per FSA earning wages below the low income cut-off.

2.3. Analyses

School and food store locations were mapped using geographic information systems (GIS) analysis using ArcMap GIS software (ESRI, Redlands, California). The availability of food stores near schools was examined by calculating the number of food stores located within 800 meter

² For more information about the definitions and calculation of low income cut-offs, please refer to Statistics Canada <http://www.statcan.gc.ca/pub/75f0002m/2009002/s2-eng.htm>

buffer distances surrounding each school. This distance represents a walk of approximately 10-12 minutes from schools (at a walking speed of approximately 4-5 km/hr).

The closest distance from individual schools to each type of food outlet was also calculated using ArcMap's Network Analyst tool. This tool calculates the closest distance to stores along street routes. The road networks were identified using CanMap RouteLogistics, v2010.3, 2010 data from DMTI Spatial Inc. Eight schools were excluded from the analysis of closest distance measures because they were not located near the road network and each of the four types of food stores were estimated to be farther than 500km away via road network distances. These outliers include schools in remote northern communities and "fly in" communities (e.g. Oweekeno Elementary in Port Hardy, BC).

Summary statistics (such as mean, standard deviation, median and range for continuous variables and frequencies for categorical variables) were calculated. Estimates were first calculated for the entire sample of schools and were then calculated separately among schools that have secondary school grades (grade 8 or higher) and schools that only serve students in younger grades and among rural and urban schools. Graphical techniques (e.g. box-plots and histograms) were reviewed to assess data distributions and to identify potential outliers.

The distributions of food stores surrounding schools with the highest quartile of food store availability were identified. From these schools, three were selected for mapping (see Figures 1-3) to provide visual examples: a) one school in a relatively affluent region (i.e. in the highest quartile of area socioeconomic status defined by FSA-level median household income and percent below the low income cut-off), b) one school located in a relatively low socio-economic status region (in the lowest FSA quartile for median household income and highest quartile for percent below the low income cut-off) and c) one school located in a downtown/inner city/high commercial density region.

Table 2: Descriptive Profile of the Food Environment Surrounding BC Schools

	Number of Schools	Snack/ Beverage Stores	Fast Food Outlets	Delis	Convenience Stores	ALL Snack, Fast Food, Deli & Convenience Stores
All Schools	1392					
Mean/s.d. (number of schools within 800m)		1.27/2.64	1.27/2.37	0.24/0.64	0.27/0.57	3.05/5.47
% with at least one store within 800m		43.68%	40.30%	16.09%	21.98%	54.17%
% with no store within 800m		56.32%	59.7%	83.91%	78.02%	45.83%
Median distance to closest store (metres) ^a		1271	1395	3283	2387	1016
Secondary Schools	380					
Mean/s.d. (number of schools within 800m)		1.11/1.95	1.22/2.06	0.20/.52	0.27/0.54	2.81/4.25
% with at least one store within 800m		46.58%	43.68%	15.53%	23.16%	58.42%
% with no store within 800m		53.42%	56.32%	84.47%	76.84%	41.58%
Median distance to closest store (metres)		1167	1233	3175	2302	898
Elementary Schools	1012					
Mean/s.d. (number of schools within 800m)		1.33/2.86	1.30/2.49	0.25/0.68	0.27/0.59	3.15/5.86
% with at least one store within 800m		42.59%	39.03%	16.30%	21.54%	52.57%
% with no store within 800m		57.41%	60.97%	83.70%	78.46%	47.43%
Median distance to closest store (metres)		1337	1474	3287	2454	1085
Rural Schools^b	561					
Mean/s.d. (number of schools within 800m)		0.64/1.28	0.58/1.25	0.12/0.39	0.18/0.46	1.53/2.73
% with at least one store within 800m		32.44%	27.27%	9.98%	15.33%	41.18%
% with no store within 800m		67.56%	72.73%	90.02%	84.67%	58.82%
Median distance to closest store (metres)		2185	2594	19,965	9230	1544

^a Eight schools in remote northern communities and fly in communities were considered extreme outliers and were excluded from analyses of closest distance to stores because no limited service stores were available within 500km road networks.

^b Schools were classified as rural if they had no census tract identifier in 2006. Rural schools had statistically lower availability of all food store types compared to urban schools (p<0.05).

3.0. Results

3.1. Number of Stores within 800m of Schools

Table 2 provides the descriptive profile of food store availability within 800m buffers surrounding schools (including mean estimates and the percent of schools with stores within 800m) as well as the estimated road distance to the closest stores. The mean number of limited service outlets surrounding schools was 3 stores (mean for all stores within 800m=3.05, s.d.=5.47, 25th percentile=0, median=1, 75th percentile=4). Approximately 46% of schools had no snack/beverage, fast food, deli or convenience store identified within 800m. The data distribution for food store variables within 800m was highly skewed, with most (75%) schools exposed to 4 or fewer outlets within 800m. However, 127 schools (approximately 8% of this sample) had 10 or more outlets within 800m.

Beverage and snack food stores were the most prevalent category of the four types of food outlets in the province (n=1511), among which Starbucks, Tim Hortons and Dairy Queen were the most commonly available. The mean number of beverage and snack food stores within 800m (mean=1.27, 25th percentile=0, median=0, 75th percentile=2) was comparable with the mean number of fast food outlets (mean=1.27, 25th percentile=0, median=0, 75th percentile=2). Table 1 describes the most common fast food chains in BC, including Subway, McDonalds, Quiznos, Panago Pizza, KFC, Domino's Pizza, Pizza Hut and Wendy's, each of which has over 50 locations in BC.

There were relatively fewer delis (n=249) and convenience stores (n=243) identified in BC. Only 16% and 22% of schools had a deli or convenience store within 800m, respectively. The majority of convenience stores were comprised of 7-Eleven and Mac's Convenience Store chains.

3.2. Closest Distance to the Nearest Outlet

The median closest distance to any outlet was just over 1km (1016m). Approximately 10% of schools had at least one food outlet available within 300 meters (by road) from the school, which represents a walk of approximately 5 minutes, and 25% of schools had an outlet available within 600 meters or less. Twenty five percent of schools were over 2km from the nearest snack/beverage, fast food, deli or convenience store (75th percentile for closest distance=2091m). The median estimates (not means) were reported for closest distance to store estimates because the means were so highly skewed by the substantial proportion of upper outliers in this variable (i.e. schools that have very long travel distances to the nearest store). For example, 17% of schools (n=244) had no outlets within 3km road networks and 104 schools were 20km or farther away from the nearest limited service outlet.

3.3. Differences among Secondary Schools and Elementary Schools

Table 2 also shows the results for store availability within 800m and proximity to the closest store stratified among secondary schools versus elementary schools. The results suggest that there were no substantial (or statistically significant, $p < 0.05$) differences in the mean availability of any types of limited service food outlets within 800m for secondary compared to elementary schools. There were a slightly higher proportion of secondary schools that had at least one outlet within 800m (58% for secondary, 53% for elementary), however these differences were not quite statistically significant ($p = 0.051$).

3.4. Urban-Rural Differences

In this sample, 831 schools were located in regions with defined census tracts (i.e. urban) and 561 schools had no designated census tract identifier (indicating rural location). Schools in rural areas had significantly fewer stores of all types within 800 meters and also had farther travel distances to the nearest stores ($p<0.05$). Looking at snack/beverage, fast food, deli or convenience stores together, rural schools had a mean of 1.53 stores available within 800m compared to 4.1 stores available near urban schools. In 59% of rural schools, no outlet was available within 800m, and the median closest distance to a limited service outlet was approximately 1.5km.

3.5. Mapping Examples

The maps presented in Figures 1-3 represent diverse examples of school neighbourhoods ranking in the highest quartile for food availability. The 800m buffer distances are illustrated by the circular rings around the schools featured in the centre of each map. These maps illustrate that in BC, there are indeed several schools with nearby access to multiple fast food and limited service outlets, and that such schools are located in both high and low income neighbourhoods in inner city and suburban contexts.

Figure 1 represents the neighbourhood surrounding a school in Burnaby, BC (Marlborough Elementary). This school is located in an FSA in the lowest quartile for median annual household income (\$38,025 in 2006), where over 33% of the households reported earning incomes below the low income cut-off. Thirty limited service outlets were identified within 800m of this school including 12 snack and beverage vendors, 14 fast food outlets and 2 convenience stores. This map suggests that a majority of these food outlets clustered along the major commercial roadway (Kingsway) and are also accessible by another nearby school (Maywood Community School).

Figure 2 represents a school (Gleneagles Elementary) in the highest income neighbourhood in this sample (FSA=V7W in West Vancouver) where the 2006 median household income was \$112,115 per year. Although this school is not in a commercially dense urban core, there were at least 7 food outlets identified within 800m, including multiple beverage and snack vendors.

Figure 3 characterizes a commercially dense region of downtown Vancouver with a median household income of \$52,928 (close to the provincial average). The school located in the centre of the map (Hasting Community Elementary) has access to limited service outlets within 200m of school grounds and has at least 14 outlets located within 800m (and several other options slightly beyond the 800m boundary). These food outlets are also accessible to several other nearby elementary and secondary schools including Dr. A.R. Lord Elementary, Garibaldi Annex, Templeton Secondary, Sir William Macdonald Community and Tillicum Community Annex.

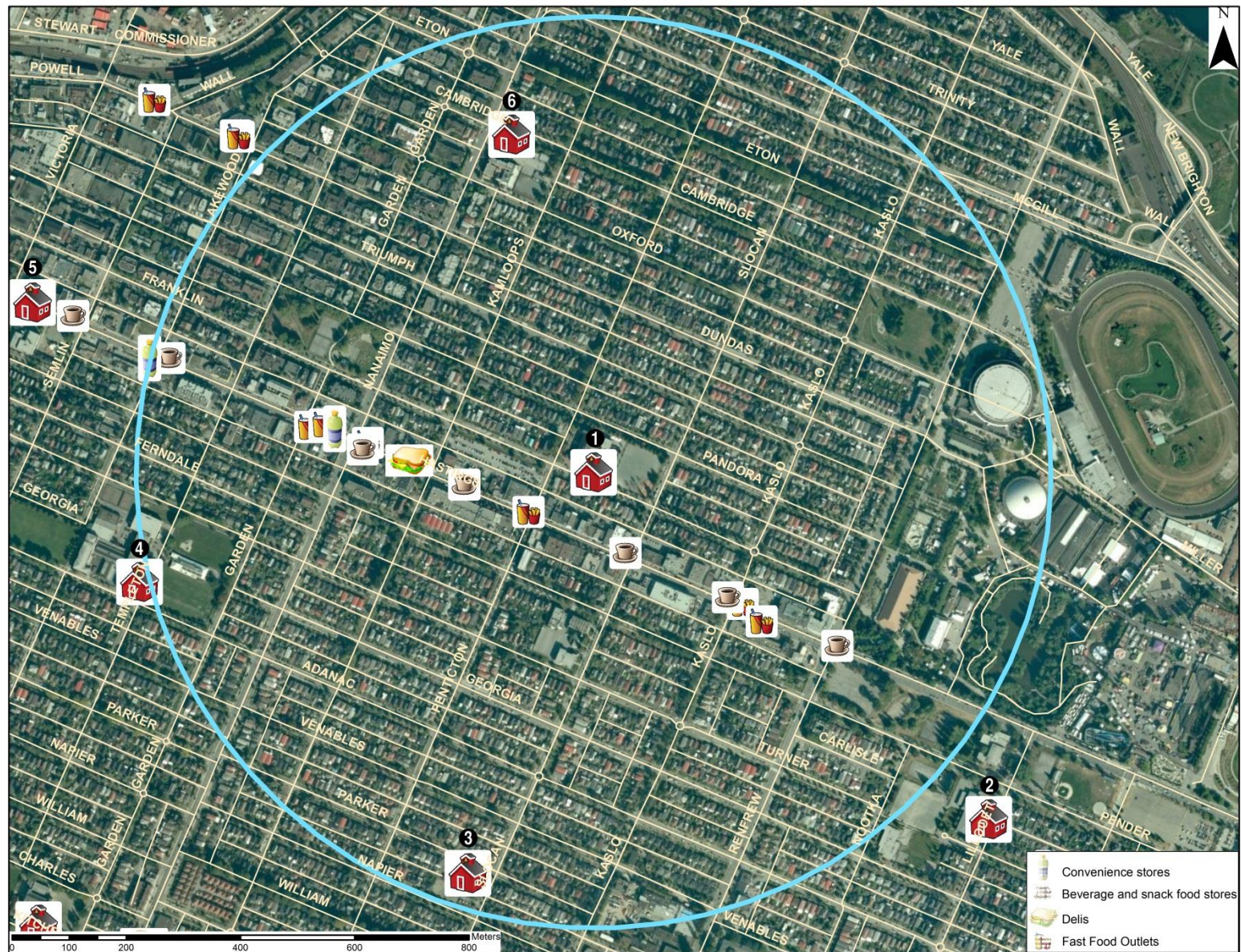
The school in centre (#1) represents Marlborough Elementary. School #2 (lower left) represents Maywood Community School.

**Figure 2: Example of a Higher Income Neighbourhood with High Food Store Availability within 800m.
West Vancouver, BC**



The school in the centre (#1) represents Gleneagles Elementary.

**Figure 3: Example of a Downtown/Inner City Neighbourhood with High Food Store Availability within 800m.
Vancouver, BC**



The school in the centre (#1) represents Hastings Community Elementary; #2=Dr. A R Lord Elementary; #3=Garibaldi Annex; #4=Templeton Secondary; #5=Sir William Macdonald Community; #6=Tillicum Community Annex.

4.0. Discussion

This preliminary analysis described a set of baseline estimates of the food environment surrounding BC schools and provides valuable insight about the availability, density, proximity and variety of limited service food outlets in BC. These findings reveal that over half the standard public schools in BC (54%) have at least one limited service food outlet within a 10-12 minute walk (800m) from school grounds and over 60% of schools have at least one store located within 1.5km. Moreover, 394 schools in this sample had access to 3 or more outlets within 800m.

It is difficult to directly compare these findings to prior studies because of methodological differences used to define “walkable” distances around school grounds and varied definitions of fast food and limited service outlets. However, the findings are comparable with recent data from Quebec that found that approximately 37% of schools are within a 15 minute walk of a fast food outlet and 62% are within walking distance to a convenience store [3]. These data can also be compared with a growing body of literature about the neighbourhood food environments developing in the U.S. and Canada [4, 5]. Estimates from the U.S. suggest that one third of schools are within walking distance to a fast food restaurant or convenience store [6], with higher fast food exposure reported near schools in large urban centres [7, 8].

However, unlike previous U.S. studies that have found increased exposure to fast food outlets around secondary schools [6, 9], there do not appear to be significant differences in food outlet exposures near secondary schools compared to schools serving only younger grades in BC. The food environment surrounding secondary schools may be particularly relevant because older students have increased autonomy over food choices and mobility during the school day. National dietary data from Canada further suggest that the transition to secondary school is associated with decreased consumption of fruits, vegetables and milk, and increased intake of low nutritional

quality foods such as soft drinks and fast food [10]. The marked increase in fast food consumption is particularly noteworthy since adolescents are more likely to consume fast food than younger children and 1/3 of Canadian teens report consuming fast-food the day before participating in health surveys [11].

Not surprisingly, this analysis also found higher exposure to limited service food vendors surrounding urban compared to rural schools. Yet, the three examples mapped in Figures 1-3 demonstrate that schools with the highest exposure to fast food and snack food outlets are found in neighbourhoods with diverse socioeconomic and land use characteristics including both high and low income neighbourhoods, as well as suburban and inner city regions.

This analysis did not explicitly examine the associations between area socio-economic conditions or land use and food outlet availability. However, an exploratory examination of the data suggests that areas with lower socio-economic status (measured as decreased median annual household income and a higher proportion of residents earning below the low income cut-off in FSAs surrounding schools) may be exposed to *increased* availability of snack, fast food, deli and convenience stores within 800m. Further examination of the land use planning and zoning characteristics (e.g. commercial density) of these neighbourhoods may further explain the patterning of food outlets in the province and warrants future attention from researchers and policy makers.

There are several strengths and limitations that should be considered in regards to this baseline analysis. An important strength was the use of a comprehensive sample of public schools characterized in the BC Ministry of Education's school database as of February 2011. This database provided key information about the programs and grades offered by each school, allowing for the comparison of schools serving secondary school students versus students in

younger grades. However, no systematic validation explicitly verified the quality or completeness of the school database or the accuracy of geographic coordinates provided by the Ministry of Citizens' Services. Moreover, this study excluded private schools, alternate programs, distributed learning programs and youth custody educational centres and findings should not be generalized to such settings.

All food store data (including latitude and longitude coordinates for each store) were obtained from the Canadian Business Data files maintained by InfoGroup, a telephone verified database of commercial businesses and food vendors [12]. To our knowledge this the highest quality proprietary data source of commercial food outlets available in BC. Further, there is evidence that food store measures developed from a comparable U.S. dataset demonstrated acceptable levels of agreement compared to direct observations made through systematic social observation and estimates do not appear to be skewed by the socio-demographic characteristics of the neighbourhood where stores are measured [13]. Still, these data have several key limitations that need to be taken into account when interpreting the findings from this study. First, no systematic validity assessments were conducted to estimate the proportion of missing data (i.e. fast food outlets that were not listed) or the proportion of out-dated data (i.e. stores that were listed but are no longer in business). It was also not possible to conduct a systematic evaluation of the accuracy of the coding system used to assign industry codes to classify stores (i.e. whether the NAICS codes and descriptions accurately categorized each outlet).

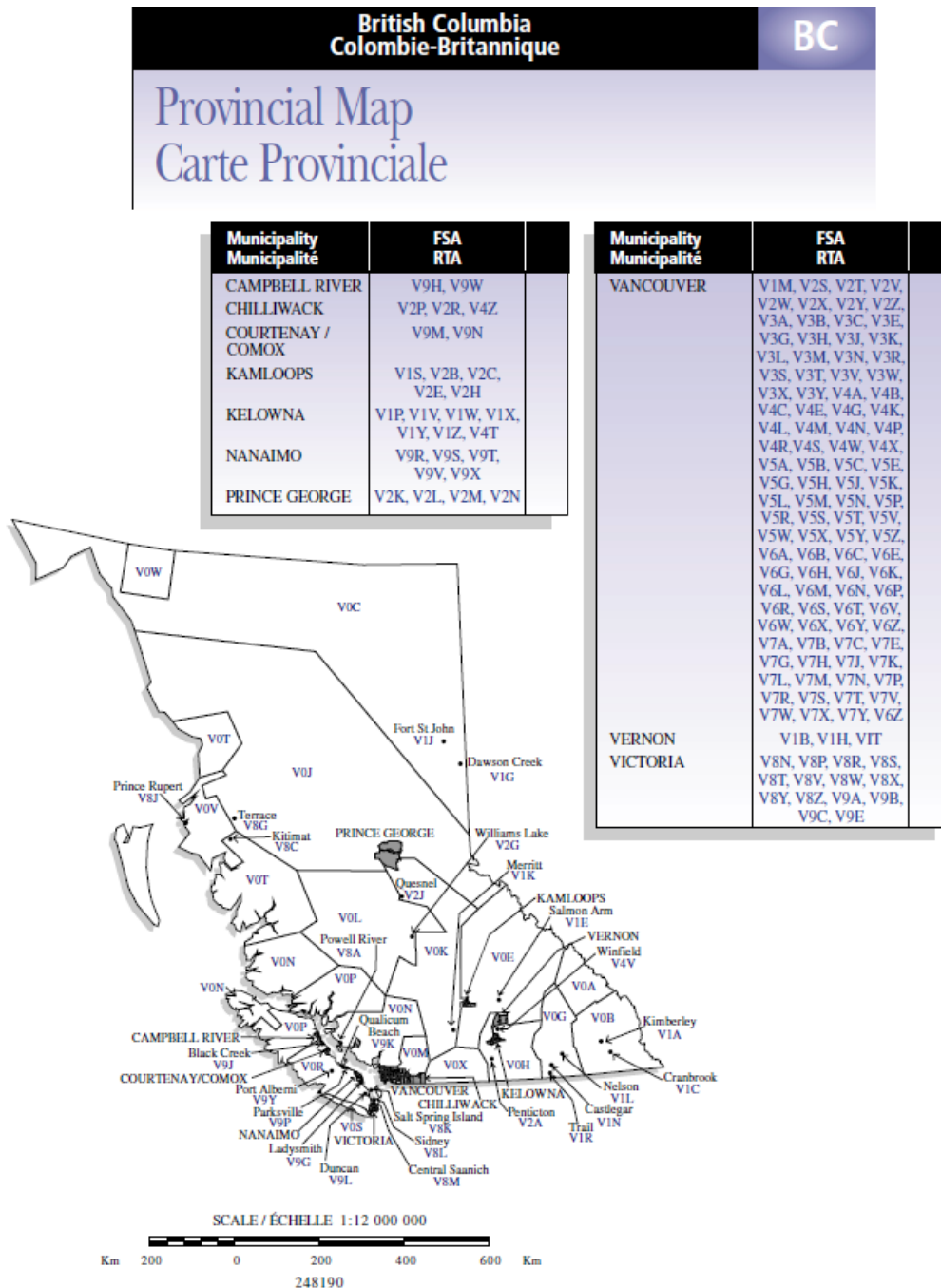
Second, fast food restaurants (including major chains such as McDonalds and KFC as well as small, independent outlets) were coded in this dataset under the NAICS description "full-service restaurants" with NAICS code 72211019. This precluded our ability to easily discern "true" fast food outlets from other full service restaurants with waiter service. We therefore could not identify

relevant fast food outlets using a single NAICS code indicator for limited service restaurants. In 2010, 9461 full-service restaurants were listed in the Canada Business Points dataset and it was not feasible to verify each location to determine if it met the study's criteria for limited-service/fast food (i.e. outlets where food is selected and purchased before being consumed). To overcome this data challenge, we identified all restaurants with three or more locations and coded each outlet in the fast food variable if it met inclusion criteria for limited service. Therefore, this analysis could not include outlets such as independent pizza shops or take out places with two or fewer locations, potentially under-representing the true number of limited service food vendors available within 800m. This study also did not quantify access to snack and take out foods available at nearby supermarkets, local grocers, community centre cafeterias or full service restaurants where students may also purchase foods or beverages during the school day.

Still, this analysis captured a substantial proportion of vendors where BC students likely purchase snacks, beverages and lunch-time foods including chain fast food vendors, convenience stores, delis and coffee shops and provides insight about the variation in key food environment exposures across the province. Additional research is needed to understand how food environment exposures surrounding schools impact food choices and dietary quality.

5.0. Appendix

Appendix A: BC Forward Sortation Area (FSA) Map



6.0. References

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